

PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner
 US Department of Commerce
 United States Patent and Trademark
 Office, PCT
 2011 South Clark Place Room
 CP2/5C24
 Arlington, VA 22202
 ETATS-UNIS D'AMERIQUE
 in its capacity as elected Office

Date of mailing (day/month/year) 15 May 2001 (15.05.01)	Applicant's or agent's file reference 2626 WO
International application No. PCT/EP00/08057	Priority date (day/month/year) 06 September 1999 (06.09.99)
International filing date (day/month/year) 17 August 2000 (17.08.00)	
Applicant HAAS, Didier et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:
06 March 2001 (06.03.01)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer Olivia TEFY
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(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
15 March 2001 (15.03.2001)

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(10) International Publication Number
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(51) International Patent Classification⁷: G21C 21/02, 3/62

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(30) Priority Data:
99116886.5 6 September 1999 (06.09.1999) EP

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(81) Designated States (national): CA, JP, NO, US.

Published:
— With international search report.

For two-letter codes and other abbreviations, refer to the "Guid-
ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.

(54) Title: METHOD FOR PRODUCING NUCLEAR FUEL PELLETS OF THE MOX TYPE

(57) Abstract: A method for producing nuclear fuel pellets of the MOX (mixed plutonium and uranium oxide) type, comprising the steps of preparing an U-pu oxide blend powder having a Pu content in excess of the finally desired value, preparing a uranium oxide powder, mixing adequate quantities of both powders in order to achieve the desired plutonium content, compacting and sintering the mixture for obtaining said pellets, wherein the step of preparing the uranium oxide powder involves the following sequence of substeps: a) preparation of an aqueous solution of uranyl nitrate to which between 0.5 and 2 wt% of organic thickeners are added such that the viscosity of the solution is adjusted to values between 20 and 100 centipoise, b) dispersion of the solution into droplets, c) introducing said droplets into a hydroxide bath, d) washing the resulting beads, e) drying the beads by azeotropic distillation using an immiscible organic solvent, f) thermal treatment of the beads in an oxidising atmosphere, g) thermal treatment in a reducing atmosphere.

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METHOD FOR PRODUCING NUCLEAR FUEL PELLETS OF THE MOX TYPE

This invention refers to a method for producing nuclear fuel pellets of the MOX (= mixed oxide) type, comprising the steps of

- preparing an U-Pu oxide blend powder having a Pu content in excess of the finally desired value,
- preparing an uranium oxide powder,
- mixing adequate quantities of both powders in order to achieve the desired plutonium content,
- compacting and sintering the mixture for obtaining said pellets.

Such a method is known under the term MIMAS ("Micronized MASTER Blend" - see for example D. Haas, M. Lippens "MOX FUEL FABRICATION AND IN-REACTOR PERFORMANCE", Proc. of the Internat. Conference on Future Nuclear Systems, GLOBAL 97, p.489 à 494). This separate preparation of a powder free of plutonium reduces the volume of plutonium containing powder that has to be milled, and allows the production of fuel pellets of various plutonium contents with a unique plutonium treatment chain by changing only the rate of admixed uranium powder.

The commercial powders currently used, however, result in a final product which is heterogeneous, i.e. contains large particles rich in plutonium oxide dispersed within an uranium oxide matrix whose grain size is below 10 μm . This heterogeneity leads to two major drawbacks:

During irradiation localised higher fissile material concentrations lead to high local burnups, to fission damages and to gas release. To limit this gas release large UO_2 grains are recommended, provided that they are produced without additives that might lead to detrimental fuel behaviour during irradiation and might also lead to difficulties during reprocessing.

During reprocessing the dissolution of the burned-up fuel in nitric acid is hindered by regions rich in pluto-

nium, which is notoriously insoluble.

The present invention aims to overcome these drawbacks and to propose a method as indicated above which leads to fuel pellets of the MOX type in which the distribution of plutonium throughout the pellet is substantially more homogeneous.

This aim is achieved by the method as defined in claim 1. As far as preferred embodiments of this method are concerned, reference is made to the secondary claims.

The invention will now be described in detail by means of preferred embodiments.

In agreement with the known MIMAS method as cited above, the method according to the invention implies the separate preparation of a Pu-U oxide powder on the one hand and an uranium oxide powder free of plutonium on the other hand.

According to a first embodiment the Pu-U oxide powder is prepared conventionally by mechanically milling PuO_2 and UO_2 materials, whereas the UO_2 powder is prepared as follows:

To an aqueous solution of uranyl nitrate small amounts, i.e. between 0.5 and 2 wt%, of organic thickeners are added, such as methocel, dextran, polyvinyl alcohol, such that the viscosity of the solution is adjusted to values between 20 and 100 centipoise. There-after, this solution is dispersed into droplets, which are introduced into an ammonia bath. In this bath, due to the network formed by the long chain organic polymers, precipitation occurs within the original droplets, so that nearly spherical beads are formed. The size of these beads depends on the size of the droplets produced during dispersion. In a preferred embodiment these beads present diameters of between 20 and 50 μm . These beads are then washed to remove nitrate salts (ammonium nitrate salts in the above example) and organic polymers, and are subjected to an azeotropic distillation using an immiscible organic solvent such as C_2Cl_4 to

remove water.

Once dried the beads are in a hydroxide form, from which they are converted to oxide by a thermal treatment of between 2 and 6 hours duration and at about 400°C in air.

5 Thereby residual organic polymers are pyrolysed. The beads are then again submitted to a thermal treatment of between 4 and 8 hours duration, this time at about 800°C and in a reducing atmosphere of Ar/5% H_2 , to convert U_3O_8 to UO_2 .

10 The beads can be produced by conventional uranium processing facilities (no α contamination). They are free flowing, dust free and do not require any further mechanical treatment such as milling prior to mixing with the powder containing plutonium. The homogeneity of the finally produced fuel can further be enhanced by sieving the beads and
15 retaining only beads with diameters in the range of 20 to 50 μ m. Alternatively this result can also be achieved by using a droplet dispersion device which produces droplets of well defined size such that the bead diameters remain within said range and no sieving becomes necessary.

20 Once mixed the MOX powder is compacted into pellets by using a press which applies a pressure of between 200 and 600 MPa. These pellets are then sintered at high temperature, preferably at 1700°C, in a humidified Ar/ H_2 atmosphere, the hydrogen content of which lies between 1 and 6% and the
25 water vapour introduction should result in a ratio of the partial H_2 pressure to the water vapour partial pressure of between 20 and 60. The water allows to control the oxygen potential of the gas atmosphere which results in an enhanced diffusion and in a more homogeneous fuel thus enabling a
30 longer burn-up in the reactor.

According to a variant of the method the powder containing an excess content of plutonium can be prepared in the same way as above described for the uranium oxide powder, but by starting with uranyl-plutonium nitrate instead
35 of uranyl nitrate.

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The inventive method can be realised in conventional MOX fabrication facilities and conserves all the advantages of the MIMAS process but does not suffer from the drawbacks of this process as mentioned above.

CLAIMS

5 1. A method for producing nuclear fuel pellets of the MOX (mixed plutonium and uranium oxide) type, comprising the steps of

- preparing an U-Pu oxide blend powder having a Pu content in excess of the finally desired value,
- 10 - preparing an uranium oxide powder,
- mixing adequate quantities of both powders in order to achieve the desired plutonium content,
- compacting and sintering the mixture for obtaining said pellets,

15 characterized in that the step of preparing the uranium oxide powder involves the following sequence of substeps:

- a) preparation of an aqueous solution of uranyl nitrate to which between 0.5 and 2 wt% of organic thickeners are added such that the viscosity of the solution is adjusted to
- 20 values between 20 and 100 centipoise,
- b) dispersion of the solution into droplets,
- c) introducing said droplets into a hydroxide bath,
- d) washing the resulting beads,
- e) drying the beads by azeotropic distillation using an
- 25 immiscible organic solvent,
- f) thermal treatment of the beads in an oxidising atmosphere,
- g) thermal treatment in a reducing atmosphere.

30 2. A method according to claim 1, characterized in that the step of preparing an U-Pu oxide blend powder consists in milling and mixing adequate quantities of uranium oxide and plutonium oxide.

35 3. A method according to claim 1, characterized in

- 6 -

that the step of preparing the U-Pu oxide blend powder involves the following sequence of substeps:

a) preparation of an aqueous solution of uranyl-plutonium nitrate to which small amounts of organic thickeners are added in order to adjust the viscosity of the solution to values between 20 and 100 centipoise,

b) dispersion of the solution into droplets,

c) introducing said droplets into a hydroxide bath,

d) washing the resulting beads,

e) subjecting the beads to an azeotropic distillation using an immiscible organic solvent,

f) thermal treatment of the beads in an oxidising atmosphere,

g) thermal treatment in a reducing atmosphere.

4. A method according to anyone of the preceding claims, characterized in that in substep a) the organic thickeners are selected among methocel, dextran and polyvinyl alcohol.

5. A method according to anyone of the preceding claims, characterized in that in substep c) the hydroxide bath consists of ammonia.

6. A method according to anyone of the preceding claims, characterized in that in substep f) the thermal treatment in an oxidising atmosphere is performed at about 400°C and in air.

7. A method according to anyone of the preceding claims, characterized in that in substep g) the thermal treatment in a reducing atmosphere is performed at about 800°C, the reducing atmosphere containing an inert gas with a hydrogen content between 1 and 6%.

8. A method according to anyone of the preceding claims, characterized in that compacting of the powder mixture into pellets is obtained by applying a pressure of between 200 and 600 MPa.

5

9. A method according to anyone of the preceding claims, characterized in that the sintering of the pellets takes place at a temperature above 1200°C, preferably between 1600 and 1700°C, and in a humidified Ar/H₂ atmosphere, the hydrogen content lying between 1% and 6% and the ratio between the partial pressures of hydrogen and water vapour being selected between 20 and 60.

10

10. A method according to anyone of the preceding claims, characterized in that before mixing adequate quantities of both powders, the UO₂-powder is sieved in order to retain only beads with diameters between 20 and 50µm size.

15

INTERNATIONAL SEARCH REPORT

Intern. Application No

PCT/EP 00/08057

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G21C21/02 G21C3/62

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G21C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, INSPEC, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	EP 1 020 873 A (EUROPEAN COMMUNITY) 19 July 2000 (2000-07-19) the whole document ---	1,2,4,10
A	US 4 382 885 A (HAAS) 10 May 1983 (1983-05-10) column 2, line 28-63 ---	1-10
A	GB 1 480 427 A (AGIP NUCLEARE) 20 July 1977 (1977-07-20) page 2, line 73 -page 3, line 2 ---	1-10
A	US 4 202 793 A (BEZZI ET AL.) 13 May 1980 (1980-05-13) abstract ---	1-10
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Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

* Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

G document member of the same patent family

Date of the actual completion of the international search

7 December 2000

Date of mailing of the international search report

15/12/2000

Name and mailing address of the ISA

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Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Frisch, K

INTERNATIONAL SEARCH REPORT

Intern. Application No

PCT/EP 00/08057

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 384 990 A (HEIN) 24 May 1983 (1983-05-24) column 4, line 20-42 ----	1-10
A	US 4 571 315 A (GERONTOPOULOS ET AL.) 18 February 1986 (1986-02-18) abstract ----	1-10
A	FR 2 622 343 A (COMMISSARIAT A L'ENERGIE ATOMIQUE) 28 April 1989 (1989-04-28) figure 2 ----	1
A	D. HAAS ET AL.: "MOX fuel fabrication and in-reactor performance" PROC. INT. CONF. ON FUTURE NUCLEAR SYSTEMS, GLOBAL 97, pages 489-494, XP000869930 cited in the application the whole document -----	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

Intern. Application No

PCT/EP 00/08057

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1020873 A	19-07-2000	WO 0042617 A	20-07-2000
US 4382885 A	10-05-1983	NONE	
GB 1480427 A	20-07-1977	IT 998980 B DE 2450916 A FR 2248872 A US 4202793 A	20-02-1976 28-05-1975 23-05-1975 13-05-1980
US 4202793 A	13-05-1980	IT 998980 B DE 2450916 A FR 2248872 A GB 1480427 A	20-02-1976 28-05-1975 23-05-1975 20-07-1977
US 4384990 A	24-05-1983	DE 2922686 A EP 0019853 A JP 55167134 A	11-12-1980 10-12-1980 26-12-1980
US 4571315 A	18-02-1986	IT 1096285 B BE 876045 A CA 1122397 A DE 2918105 A ES 480679 D ES 8201344 A FR 2425128 A GB 2020260 A,B JP 1059556 B JP 1581548 C JP 55000490 A LU 81224 A NL 7903520 A,B,	26-08-1985 05-11-1979 27-04-1982 08-11-1979 01-12-1981 01-03-1982 30-11-1979 14-11-1979 18-12-1989 11-10-1990 05-01-1980 10-09-1979 07-11-1979
FR 2622343 A	28-04-1989	JP 1148994 A JP 2761225 B	12-06-1989 04-06-1998

PATENT COOPERATION TREATY

PCT

NOTIFICATION CONCERNING
SUBMISSION OR TRANSMITTAL
OF PRIORITY DOCUMENT

(PCT Administrative Instructions, Section 411)

From the INTERNATIONAL BUREAU

To:

WEINMILLER, Jürgen
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ALLEMAGNE

Frist: Vorlage:

21. Dez. 2000

Date of mailing (day/month/year) 13 December 2000 (13.12.00)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference 2626 WO	
International application No. PCT/EP00/08057	International filing date (day/month/year) 17 August 2000 (17.08.00)
International publication date (day/month/year) Not yet published	Priority date (day/month/year) 06 September 1999 (06.09.99)
Applicant EUROPEAN COMMUNITY (EC) et al	

1. The applicant is hereby notified of the date of receipt (except where the letters "NR" appear in the right-hand column) by the International Bureau of the priority document(s) relating to the earlier application(s) indicated below. Unless otherwise indicated by an asterisk appearing next to a date of receipt, or by the letters "NR", in the right-hand column, the priority document concerned was submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b).
2. This updates and replaces any previously issued notification concerning submission or transmittal of priority documents.
3. An asterisk(*) appearing next to a date of receipt, in the right-hand column, denotes a priority document submitted or transmitted to the International Bureau but not in compliance with Rule 17.1(a) or (b). In such a case, **the attention of the applicant is directed** to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.
4. The letters "NR" appearing in the right-hand column denote a priority document which was not received by the International Bureau or which the applicant did not request the receiving Office to prepare and transmit to the International Bureau, as provided by Rule 17.1(a) or (b), respectively. In such a case, **the attention of the applicant is directed** to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

<u>Priority date</u>	<u>Priority application No.</u>	<u>Country or regional Office or PCT receiving Office</u>	<u>Date of receipt of priority document</u>
06 Sept 1999 (06.09.99)	99116886.5	EP	07 Dec 2000 (07.12.00)

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INTERNATIONAL SEARCH REPORT

Intern. Application No

PCT/EP 00/08057

A. CLASSIFICATION OF SUBJECT MATTER
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B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G21C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, INSPEC, PAJ

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	-/--	



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

Z document member of the same patent family

Date of the actual completion of the international search

7 December 2000

Date of mailing of the international search report

15/12/2000

Name and mailing address of the ISA

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INTERNATIONAL SEARCH REPORT

Intern. Application No

PCT/EP 00/08057

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
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A	D. HAAS ET AL.: "MOX fuel fabrication and in-reactor performance" PROC. INT. CONF. ON FUTURE NUCLEAR SYSTEMS, GLOBAL 97, pages 489-494, XP000869930 cited in the application the whole document -----	1

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)



Applicant's or agent's file reference 2626 WO	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/EP00/08057	International filing date (day/month/year) 17/08/2000	Priority date (day/month/year) 06/09/1999
International Patent Classification (IPC) or national classification and IPC G21C21/02		
Applicant EUROPEAN COMMUNITY (EC)		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.
- ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☒ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 06/03/2001	Date of completion of this report 20.08.2001
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Frisch, K Telephone No. +49 89 2399 2559 

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/EP00/08057

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, pages:

1-4 as originally filed

Claims, No.:

1-10 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/EP00/08057

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-10
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-10
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-10
	No:	Claims	

2. Citations and explanations
see separate sheet

VI. Certain documents cited

1. Certain published documents (Rule 70.10)

and / or

2. Non-written disclosures (Rule 70.9)

see separate sheet

Concerning Part V: Novelty, Inventive step, Industrial applicability:

1. The P,X-category document mentioned in the international search report was published on 19-7-2000, i.e. after the priority date (6-9-1999) but before the international filing date (17-8-2000) of the present application. Since the priority appears to be validly claimed (see the published priority application EP-A-1.081.716), the P,X-document cannot be cited against the claims of the present international application. It may, however, be of relevance in subsequent national or regional patent proceedings, since the method disclosed in the P,X-document apparently includes all method steps of at least the present claim 1.
2. None of the documents of category A mentioned in the international search report discloses a method of producing mixed-oxide fuel pellets as set out in claim 1; none of these documents discloses the steps for preparing a (plutonium-free) UO_2 powder stated in the characterizing part of claim 1, which powder is then mixed with a second U-Pu oxide blend powder to obtain the final powder mixture used in pellet fabrication. The claimed method is therefore considered to be new over the available prior art (Article 33.2 PCT).
3. Starting from the closest prior art as disclosed in the article by D. Haas et al. (=D1) or FR-A-2.622.343 (=D2), i.e. from a method corresponding to the preamble of claim 1, the skilled person is faced with the problem of producing oxide starting powders which lead to the MOX type fuel pellets having a homogeneous plutonium distribution (present application, page 2, lines 2-6). In D1 (section 3.2.1, first two paragraphs) it is recognized that this can be achieved if the UO_2 powder is free-flowing and has certain characteristics, but the necessary characteristics are not stated. Neither D1 nor D2 explains how the UO_2 powder is produced.

Several of the remaining A-category documents mentioned in the international search report relate to the production of uranium oxide starting powders for the production of nuclear fuel pellets and disclose methods including many of the steps set out in the characterizing part of claim 1. However, none of these documents describes a method including all the steps stated in the characterizing part of claim 1, and none suggests that the resulting powders will have properties which make them suitable for the MOX processes of D1 or D2. The skilled person

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would therefore have no incentive to seek to combine the teachings of these documents with the processes of D1 or D2 and would not in an obvious way obtain the method of claim 1 through such a combination. The method defined in claim 1 is therefore considered to involve an inventive step over the available prior art (Article 33.3 PCT).

4. Claims 2-10 each include all the features of claim 1. The methods defined in these claims are therefore also considered to be new and inventive over the available prior art (Articles 33.1-33.3 PCT).

Concerning Part VI; Certain documents:

EP-A-1.020.873, published on 19-7-2000

NATIONAL STAGE APPLICATION

UNDER 35 U.S.C. § 371

(CHAPTER II OF PCT)

NOTIFICATION CONCERNING
SUBMISSION OR TRANSMITTAL
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